

What is claimed:

1. A process for selectively oxidizing carbon monoxide from an input gas stream comprising carbon monoxide, oxygen and hydrogen, comprising: contacting the input gas stream with a preferential oxidation catalyst, wherein the preferential oxidation catalyst comprises:
 - at least 50 wt.% of an oxide support selected from the group consisting of activated alumina, zirconia, titania, silica, zeolites, zinc oxide and combinations thereof;
 - copper or an oxide thereof dispersed on the oxide support;
 - 0.01 to 0.5 wt.% of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the oxide support; and
 - a reducible metal oxide selected from the group consisting of oxides of chromium, vanadium, molybdenum, cerium, praseodymium, neodymium, titanium, nickel, manganese, cobalt, and combinations thereof dispersed on the oxide support.
2. The process of claim 1, wherein the platinum group metal comprises platinum.
3. The process of claim 1, wherein there is at least 5 wt.% copper or an oxide dispersed on the oxide support.
4. The process of claim 1, wherein the reducible metal oxide comprises cerium oxide.
5. The process of claim 1, wherein the support comprises activated alumina.
6. A process for selectively oxidizing carbon monoxide from an input gas stream comprising carbon monoxide, oxygen and hydrogen, comprising: contacting the input gas stream with a preferential oxidation catalyst, wherein the preferential oxidation catalyst comprises:
 - at least 50 wt.% of an alumina support;
 - copper or an oxide thereof dispersed on the alumina support;
 - 0.01 to 0.5 wt.% of platinum on the alumina support; and

cerium oxide dispersed on the alumina support.

7. The process of claim 6, wherein there is at least 10 wt.% cerium oxide in the preferential oxidation catalyst.
8. The process of claim 6, wherein
the support comprises at least 65 wt.% of activated alumina;
there is at least 5 wt.% copper or an oxide;
there is at least 10 wt.% cerium oxide;
the platinum group metal comprises platinum; and
there is at least 10 wt.% cerium oxide in the preferential oxidation catalyst.
9. The process of claim 6, wherein the alumina support is in the form of particles having a mesh size of 12 or greater, and a BET surface area of 10 m²/g or greater.
10. The process of claim 6, wherein the preferential oxidation catalyst is in the form of a washcoat composition deposited on a monolith substrate.
11. The process of claim 6, wherein there is at least 10% by volume hydrogen in the input gas stream.
12. The process of claim 6, wherein the O₂/CO ratio in the input gas stream is about 0.25 to 5.
13. The process of claim 6, wherein the input gas stream further comprises steam.
14. The process of claim 6, wherein the contacting is conducted at a temperature of about 80 °C to about 160 °C.
15. A process for selectively oxidizing carbon monoxide from an input gas stream comprising carbon monoxide, oxygen and hydrogen, comprising: contacting the

input gas stream with a preferential oxidation catalyst, wherein the preferential oxidation catalyst comprises:

- a cerium oxide support;
- copper or an oxide thereof dispersed on the cerium oxide support; and
- 0.2 wt.% or more of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the cerium oxide support.

16. The process of claim 15, wherein the platinum group metal comprises platinum.
17. The process of claim 16, wherein there is:
 - 5 to 14 wt.% of copper or an oxide thereof dispersed on the cerium oxide support; and
 - 0.2 to 5 wt. % platinum dispersed on the cerium oxide support in the preferential oxidation catalyst.
18. The process of claim 15, wherein the preferential oxidation catalyst is in the form of a washcoat composition deposited on a monolith.
19. The process of claim 15, wherein the O_2/CO mole ratio in the input gas stream is about 0.25 to about 5.
20. The process of claim 15, wherein there is at least 10% by volume hydrogen in the input gas stream.
21. The process of claim 15, wherein the input gas stream further comprises steam.
22. The process of claim 15, wherein the contacting is conducted at a temperature between 80 to 160 °C.
23. A process for removing carbon dioxide from an input gas stream comprising carbon monoxide and hydrogen, the process comprising:

- (i) contacting the input gas stream with an upstream preferential oxidation catalyst to produce a first outlet gas stream, wherein the upstream preferential oxidation catalyst is operable to produce a carbon monoxide concentration of less than 1000 ppm; and
- (ii) contacting the first outlet gas stream with a downstream preferential oxidation catalyst to produce a second outlet gas stream, wherein the downstream preferential oxidation catalyst comprises:
- at least 50 wt.% of an alumina support;
 - copper or an oxide thereof dispersed on the alumina support;
 - 0.01 to 0.5 wt.% of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the alumina support;
 - and
 - cerium oxide dispersed on the alumina support.
24. The process of claim 23, wherein the platinum group metal in the downstream preferential oxidation catalyst comprises platinum.
25. A process for removing carbon dioxide from an input gas stream comprising carbon monoxide and hydrogen, the process comprising:
- (i) contacting the input gas stream with an upstream preferential oxidation catalyst to produce a first outlet gas stream, wherein the upstream preferential oxidation catalyst is operable to produce a carbon monoxide concentration of less than 1000 ppm; and
- (ii) contacting the first outlet gas stream with a downstream preferential oxidation catalyst to produce a second outlet gas stream, wherein the downstream preferential oxidation catalyst comprises:
- a cerium oxide support;
 - copper or an oxide thereof dispersed on the cerium oxide support; and
 - 0.2 wt.% or more of a platinum group metal selected from the group consisting of platinum, palladium, rhodium, osmium, iridium, ruthenium and combinations thereof dispersed on the cerium oxide support.

26. The process of claim 25, wherein the platinum group metal in the downstream preferential oxidation catalyst comprises platinum.

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